**Waves and Sound Summary Sheet**

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| **Nature of Waves** | |
| 1. Traveling disturbance in a medium 2. Carry energy from one place to another 3. Two kinds of waves 4. **Longitudinal** – motion in direction of travel 5. **Transverse** – motion perpendicular to direction of travel | **Transverse Longitudinal** |
| **Properties of Waves** | |
| **Waves**:     1. Cycle – Unique part of wave is one cycle 2. Amplitude (A) – One half of total displacement 3. Period (T) – Time for one cycle to complete (s) 4. Frequency (f) – Cycles per second (Hz) 5. Wavelength (λ) – distance of one cycle (m) 6. Speed of wave (*v*) – frequency x wavelength    1. Depends only on the properties of the medium | |
| **Wave Velocity on a String – depends on string tension and mass density** | |
| *v* = speed (m/s)  F = Tension in string (N)  m = mass of string (kg) m/L = linear density (kg/m)  L = length of string (m) |  |

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| **Sound Waves – are longitudinal pressure waves** | | |
| 1. Longitudinal Pressure Waves 2. High pressure region called the condensation region 3. Low pressure region called the rarefaction region 4. Spread out from their source 5. Frequencies correspond to pitch of sound and range from 20 – 20,000 Hz 6. Sounds below 20 Hz are called infrasonic, sounds above 20 kHz are called ultrasonic. 7. Low frequency sounds travel further before losing energy 8. Speed of sound depends on temperature (higher temperature = faster sound waves) 9. Intensity = P/A (W/m2). Sound is compared to the threshold of hearing using the dB scale. | | |
| **Doppler Effect – relative motion between source and observer impact frequency** | | |
| 1. Source or observer moving causes Doppler effect. 2. Sound change is abrupt. 3. Source/Observer approaching each other – higher frequencies. 4. Source/Observer moving away from each other – lower frequencies | See last page for Doppler Effect formulas | |
| **Superposition – adding two or more waves together** | | |
| When two or more waves are present simultaneously at the same place, the resultant disturbance is the sum of the disturbances from the individual waves. | **Constructive Interference** – two waves are “in phase” and add together to create larger amplitude wave. | **Destructive Interference** – two waves are “out of phase” and add together to create smaller amplitude wave. |

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| **Diffraction – the bending of waves around an obstacle or barrier** | | | | |
| When λ/D is small – θ is small – narrow dispersion  When λ/D is large – θ is large – wide dispersion | | | |  |
| **Beats – beats occur when two waves have almost the same frequency** | | | | |
| Beats are alterations in loudness due to interference between two waves with nearly the same frequency.  The **beat frequency** is given by: fb = |f2 – f1| | | |  | |
| **Standing Waves** | | | | |
| **Transverse** standing waves   * Nodes are λ/2 apart * Fundamental frequency is one half wavelength. * 2nd harmonics is twice the fundamental frequency.   Hz, where  *v* = speed of wave, L = length |  | | | |
| **Longitudinal** standing waves - **Open Tube**  Hz, where  *v* = speed of wave, L = length | | **Longitudinal** standing waves **One end of Tube closed**  Hz, where  *v* = speed of wave, L = length | | |

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| **Doppler Effect Equations** |
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